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Finland

ABOUT USE OF PHOTOGRAMMETRIC METHODS
IN DEVELOPING COUNTRIES
WITH SPECIAL ATTENTION TO THE POSSIBILITIES
PROVIDED BY THE FINNISH HORIZON
AND STATOSCOPE MEASUREMENTS

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About Use of Photogrammetric Methods In Developing Countries With Special
Attention To The Possibilities Provided By The Finnish Horizon and
Statoscope Measurements.

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In case no maps exist of the area to be surveyed, the first task is to carry out aerial photography to provide photographs for a photo mosaic of the area. The photo mosaic is indispensable for navigation and as a base for further planning of the area. The photography will be done, depending on the equipment, at a scale of 1: 50'000 - 1:80'000. The photographs are compiled in the picture scale, matched to successive photographs without regard to control points, to a mosaic, which directly or copied can be used for navigation and for the other indicated purposes above. The first assembly can be prepared at the flight base even from contact prints, if no rectifier is available.

The ordinary photography, which should be made to fulfil as many purposes as possible, is made depending on various conditions at a scale of about 1:50'000 with a wide angle camera furnished with a horizon camera (13). As the camera constant is about 15 cm and the picture size about 23 x 23 cm the flying height will be about 7500 m.

In several cases the assembly made of rectified photographs, the controlled photo mosaic, will alone be sufficient to fulfil the mapping requirements of the area. In such a case the control point net is prepared using mechanical radial-line triangulation. The triangulation is made at a scale, which is approximately two times the picture scale. In estimating the density of geodetic control points it can be stated, that the distances at the scale of triangulation between adjacent stations should be about 1 m. This means, that the corresponding distance in the triangulation net will be 20-25 km.

Assuming that also the horizon has been photographed in connection with the ordinary photography the pictures can be rectified to the desired scale with one single rectification (1). Terrain with extremely high variation in elevation may require partial enlargements. The compilation of the photographs can be done at the same scale as that of the final photo mosaic, for instance 1:25'000. For assembly work at this scale the Finnish wet method is recommended of which good results have been obtained over several decades. The triangulation has to be made as a nadir point triangulation — using rectified photographs. With horizon measurement this is always possible and here will especially be stressed the fact, that the mechanical radial-line triangulation in this version is theoretically free from distortion. Using approximately this method large areas in northern Finland have been mapped for sylvicultural purposes (14). For many natural resource investments and field investigations the controlled photo mosaic is the most suitable. This method offers the advantage of having great working speed and low production cost in combination with the fact, that not highly qualified personnel is required. To prepare first a photo mosaic has often proved to be well worth while even when a map with contour lines made in a stereoscopic plotting instrument later will be made. With limitations a photo mosaic may be used as basic map, which has been provided with data of height variations in the terrain.

The preparation of a more complete map in a stereoscopic plotting instrument begins with space triangulation. For this purpose the same photography 1:50'000 can be utilized. Considering the picture scale the final map may show a contour interval of 5 metres or with limitations 2.5 metres. The scale of the corresponding topographic map may not be greater than 1:10'000. To determine the horizontal control for this map the above

mentioned geodetic triangulation net with a density of 20-25 km between adjacent stations will be sufficient.

Height determination in the field has to be carried out more or less frequently depending on the desired accuracy in elevation. Such height determination is considerably less expensive than the measurement of plane coordinates in the field.

The ordinary map can be established on the space triangulation points and plotted as soon as necessary investments have been carried out in the field, again using the same photography.

In the space triangulation, which is essential for both the quality and the cost of the mapping, the results from the horizon and the stadiometer measurements can be again utilized (6). Regardless how this triangulation will be done the results of the stadiometer and horizon measurement always will increase the confidence and speed of the triangulation and thus correspondingly decrease the amount of time-consuming and expensive measurements in the field.

A more detailed procedure is highly influenced by local conditions and can easily be derived from the general outline above by a professional mapmaker. A new device, that may be of decisive importance to the mapping of the areas in question, is the so-called Aero-dist (15). Through this application of the Tellurometer in aerial photography it should be possible to measure also the factors of the elements of outer orientation that determine the camera position. As the horizon camera adds to this information the tilt components of the picture plane, these together will create a system, which, without reservation, gives a far better solution compared to the conventional methods.

Concerning organizational problems it may first be stated, that in the developing countries the air photography preferably should be given to foreign contractors. The photography requires expensive instruments and experienced personnel, which can be used only for a part of the year. As there are qualified firms all over the world available these can undertake the photography. Later when the first mapping stage is finished and large scale works of more limited areas are to be executed may equipment for aerial photography be purchased and native personnel trained.

To prepare a map with the method of compiling controlled mosaic is the simplest photogrammetry. For this work natives of the country in question may be trained. The required devices are also less comprehensive both to their construction and to their cost. The work, however, should be started in some country with experience in mapping techniques, where the persons to be trained could receive adequate long practical education and experience. According to progress in the training the compilation of controlled photo mosaic could gradually be transferred to the country in question. Selecting persons to be trained the quantity should be taken considerably higher than the final demand, especially for the reason, that the most prominent students could be further trained for stereoscopic works.

It is further advisable to do the stereoscopic mapping, both the aerial triangulation and the plotting, to a rather great extent abroad. The instruments needed for the work are comparatively complicated and the personnel should have considerable knowledge in mathematics-natural science. Although arrangements of this kind depend on local conditions it has been proved, that stereo laboratories established in developing countries have not reached full capacity regardless of the fact, that the establishment and training of personnel periodically have been done by foreign experts. To obtain better results from an expensive stereo laboratory it should first be assured that the country owns a sufficient number of persons with adequate educational level. To provide instruments and establish the laboratory in itself is no problem but its successful operation is one.